



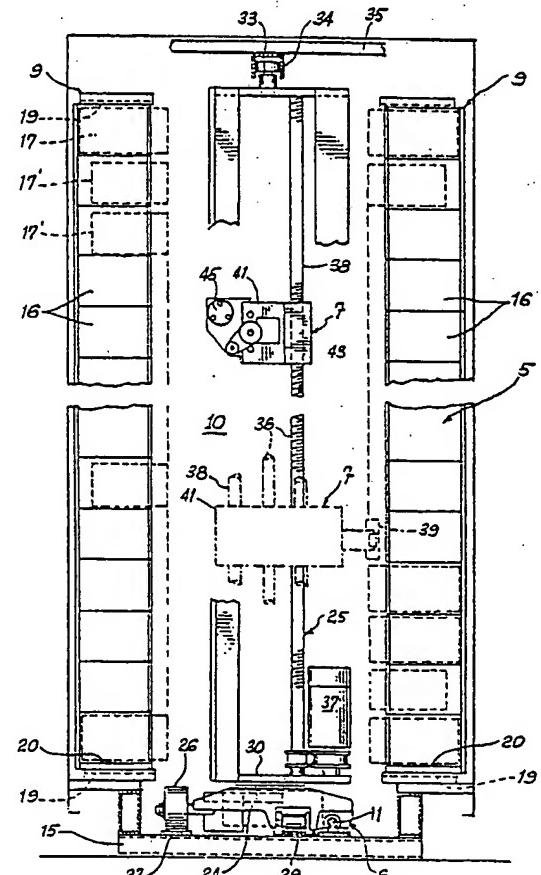
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**(54) Title:** MODULAR VENDING MACHINE

(57) Abstract

A machine for automatically dispensing videocassettes or similar items for rental or sale and for receiving returned videocassettes so that the entire procedure for renting or purchasing such items can be carried out on a self-service basis. The dispensing machine (1) includes a storage area (5) for storing a plurality of items in predetermined locations, a customer order entry device (3) to allow customers to select and enter chosen items for rental or purchase, and a tape transport device (6) for picking up a customer selected item from its location in the storage area and delivering it to a customer at a suitable delivery outlet of the machine, and for picking up customer returned items and returning them to selected locations in the storage area. A programmable device responds to customer requests to control operation of the machine.



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## MODULAR VENDING MACHINE

### DESCRIPTION

#### Field of the Invention

The present invention relates to a machine for vending or dispensing articles such as video-cassettes and the like on a self-service basis. It  
5 is particularly directed towards a machine for automatically dispensing customer selected articles such as videocassettes for rental or purchase, and for receiving returned videocassettes after a rental period.

#### Background Art

Items such as videocassettes, music cassettes and books are normally stocked by stores in great variety and numbers, requiring relatively large storage areas accessible to the customer, and a  
15 logical storage arrangement so that a selected item can be found relatively easily. This takes up a significant amount of the shop assistants' time, and problems often arise in organizing stock and keeping track of what is and is not available at  
20 any time.



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The market for videocassette rental and sales is rapidly expanding with the increasing use of videocassette recorders by consumers. Many stores have been set up to sell and rent videocassettes, 5 and numerous existing stores have added videocassette rental and sales departments. This requires extra staff to organize and keep track of rentals, and increasing storage areas to organize the videocassettes.

10 Videocassette vending machines have been proposed in the past to supply videocassettes to customers more efficiently. U.S. Patent No. 4,300,040 of Gould et al describes a terminal for previewing and ordering videocassettes, which are 15 then dispatched to the customer from a central processing location or dispensed from the terminal. Rented videocassettes can then be mailed back to the central locational or deposited in a return slot in the machine. A similar terminal is 20 described in U.S. Patent No. 4,414,467 of Gould. In each case videocassettes are simply returned via a return slot in the terminal, and no mechanism for



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automatically re-filing or storing returned videocassettes is described.

Disclosure of the Invention

It is an object of the present invention to  
5 provide a machine for the storage and automatic dispensing of items such as videocassettes for  
rental or purchase.

It is a further object of this invention to  
provide such a machine which also allows a customer  
10 to return rented items.

According to the present invention a vending machine is provided for dispensing items such as videocassettes to customers on a self-service basis. The machine includes a storage area for  
15 storing a plurality of items, a manual entry device for a customer to select a chosen item, a delivery slot for delivery of items to a customer, a pick-up device for picking up a selected item from the storage area and returned items from the delivery  
20 slot, a transport device for driving the pick-up device between the storage area and the delivery slot, and a control mechanism for controlling



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operation of the transport and pick-up devices in response to customer commands at the manual entry device to drive the pick-up device to the location of a customer selected item in the storage area, to 5 activate the pick-up device to pick up the selected item, and to transport the pick-up device to the delivery slot to deliver the item to the customer. The control mechanism operates the transport and pick up devices in reverse to pick up returned 10 rental items from the delivery slot and transport them back to the storage area. The machine is preferably designed for storage and dispensing of videocassettes for rental or purchase on a self-service basis.

15 In a preferred embodiment of the invention the control mechanism comprises a programmable machine or data processor. The programmable machine includes data storage or memory for associating each videocassette with a particular location in 20 the storage area. Information on customer sales and rentals can also be stored in the memory.



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The machine can operate either to pick up a selected videocassette and deliver it to a customer, or to pick up a returned videocassette from a customer and return it to the storage area.

5       The machine includes a device for collecting payment for rented or purchased videocassettes. This preferably comprises a credit card entry slot and reader.

In a preferred embodiment of the invention the  
10      storage area comprises two rows of cassette retaining shelves which face one another with the transport device running in an aisle between the shelves to transport the pick-up device to and from a particular videocassette location. The pick-up  
15      device is mounted on an elevator to raise or lower it to the correct shelf level to pick up a selected videocassette, and to subsequently move it up or down to the customer delivery level. The shelves preferably comprise individual cassette  
20      compartments arranged in rows and columns, in each of which an individual VHS or Beta videocassette can be located. In an alternative embodiment the



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storage area may comprise a generally circular shelf assembly, with the pick-up device mounted on the transport device within the assembly, the transport device acting simply to drive the pick-up device up and down and rotate it to reach the chosen cassette location. The shelf depth is arranged so that videocassettes will project partly into the aisle area so that they can be easily picked up by the pick-up device at their projecting ends.

In a preferred embodiment of the invention the storage area comprises one or more modular shelving units for storing videocassettes. The shelving units each comprise two rows of cassette retaining shelves facing one another with a guide or rail for the transport device running along the aisle between the shelves. A customer console including the manual entry device and the delivery slot is preferably also provided in a similar modular unit, the customer console unit having the customer console and control mechanism on one side of the aisle and a row of cassette retaining shelves on

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the other side. The cassette retaining shelves in each unit comprise a vertical array of compartments or slots which are preferably designed to each hold one videocassette of the VHF or Beta type. Spacers 5 may be provided to change the shelf dimensions for Beta tapes. The shelf depth is such that each videocassette projects out a certain amount into the aisle between the two rows to enable it to be easily picked up by the device.

10 In the preferred embodiment of the invention the transport device comprises a truck for driving the pick-up device along the aisle between the rows of shelves and an elevator mounted on the truck for raising and lowering the pick-up device between the 15 correct shelf level and the level of the delivery slot. Preferably, each videocassette is associated with a particular location in the storage area by the data processor, which can thus control the truck and elevator to drive the pick-up device to 20 the correct location.

The pick-up device may be mounted on a turntable so that it can be rotated until it faces

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towards the correct row of shelves. The pick-up device is then driven out to pick up the cassette from the slot, and then retracted back into the elevator. The elevator is lowered and the truck is 5 driven to the delivery slot to deliver the cassette to the customer.

The procedure for delivering videocassettes is reversed when rented cassettes are returned to the machine.

10 The pick-up device preferably includes a device for checking that the correct videocassette is being picked up or returned. In a preferred embodiment this comprises a magnetic read/write assembly which can read data from a magnetic strip 15 on the videocassette to check that it is correct, and at the same time write data onto the strip, such as the rental date, credit card details and so on. The assembly is mounted so that the strip will pass across its read/write head when retracted into 20 the elevator.

The videocassette vending machine thus provides a compact and convenient system for



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storing, renting and vending videocassettes and other items. The videocassettes are selected by the customer and delivered automatically, and customers can make payments automatically using the  
5 credit card reader. The machine can be situated in a variety of locations for easy access and convenience of customers, and will cut down on the costs of providing a video rental service since no sales personnel are required.

10 Brief Description of the Drawing

Figure 1 is a perspective view showing a videocassette vending machine according to a preferred embodiment of the invention;

15 Figure 2 is a front elevational view of the machine, partly cut away to show part of the cassette storage area;

Figure 3 is a side view of the interior of the machine, showing the transport device running between the rows of shelves with the pick-up device  
20 in an elevated position;

Figure 4 is a perspective view of one of the cassette magazines for storing cassettes;



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Figure 5 shows the mounting of cassette magazines in the shelving frame;

5           Figure 6 is a section on the lines 6-6 of Figure 5, showing one of the magazine storage compartments or shelves for storing individual videocassettes;

Figure 7 shows a spacer for fitting a Beta tape in a magazine storage compartment;

10           Figure 8 is a top plan view showing the transport and cassette pick-up devices in more detail;

Figure 9 is a view on the lines 9-9 of Figure 8, with the pick-up device in an elevated position;

15           Figure 10 shows the pick-up device in more detail;

Figure 11 is a side view of the pick-up device;

Figure 12 is a front elevational view of the pick-up device;

20           Figure 13 is a view similar to Figure 12 with the end plate removed to reveal the gripper jaws and slide assembly of the pick-up device;



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Figure 14 is a rear elevational view of the pick-up device showing the gripper drive mechanism;

Figure 15 shows the magnetic strip reader assembly of the pick-up device;

5       Figure 16 shows a plan view of a modified transport device including a temporary storage area for videocassettes;

10      Figure 17 is a plan view showing an alternative arrangement for the cassette storage area and transport device; and

15      Figure 8 is a block diagram illustrating the computer control mechanism for controlling operation of various peripheral devices of the machine in response to customer commands.

15      Description of the Preferred Embodiment

The drawings show a preferred embodiment of an automatic videocassette dispensing machine according to the invention.

20      As shown in Figures 1 to 3, the machine 1 basically comprises a customer console 2 including a manual entry device 3 for customers to place orders and a delivery slot 4 for delivery of



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videocassettes to customers and return of rented videocassettes from customers, and a storage area 5 for storing a variety of videocassettes. A transport device 6 (see Figure 3) is provided for 5 transporting a videocassette pick-up device 7 to and from the storage area 5 and delivery slot 4. As will be described in more detail below in connection with Figure 18, a control mechanism is provided to control operation of the transport and 10 pick-up devices in response to customer commands.

In the preferred embodiment, the machine is in modular form, comprising a series of one or more modular units 8 which can be connected together as desired to increase or decrease the storage area. 15 As shown in Figure 3, the storage area 5 basically comprises two rows 9 of shelves with an aisle 10 running between the shelves. The transport device 6 is guided on a rail 11 running along the aisle 10. Each modular unit is in the form of a section 20 of storage area 5, except for one unit 12 which incorporates the customer console 2. In the console unit 12 one row of shelves is replaced by



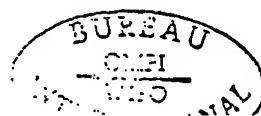
-13-

the customer console 2, and the control mechanism is located in the area 13 behind the console 2. End walls 14 are provided at each end of the machine to restrict access to the storage area.

5 These can be removed to add extra storage units when more storage space is needed. In the embodiment shown the machine has a base 15 in which the rail 11 is mounted, and the rows of shelves are mounted in the base as shown in Figure 3. The base

10 15 may also be in modular form. Alternatively, the modular units may each include a base portion.

As shown in Figures 2 and 3, the rows of shelves 9 comprise a vertical array of compartments or slots 16, in each of which a single 15 videocassette 17 can be located so as to project slightly inwardly into the aisle between the rows. The vertical array is made up of a series of individual cartridges 18 as shown in Figure 4, each cartridge comprising a single vertical column of compartments 16. The cartridges 18 are mounted in slots 19, provided for that purpose in an outer 20 frame 20 on either side of the aisle 10.



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As shown in Figures 3, 4 and 5, the cartridges 18 have upper and lower ribs 21 which engage in the aligned upper and lower slots 19 in the frame 20 on either side of the aisle 10. Cartridges can thus 5 be removed and replaced when necessary. As shown in Figures 5 and 6, the cartridges are spaced apart a certain amount when mounted in the frame so that there will be gaps between adjacent videocassettes 17 to allow them to be removed by the pick-up 10 device as described below.

The size of the compartments 16 is such that a VHS type videocassette will project out into the aisle area a certain amount as shown in Figure 3. Spacers 22 as shown in Figure 7 are provided for 15 reducing the compartment length such that Beta tapes 17' (see Figure 3), project out by the same amount.

The customer console 2 is shown in Figures 1 and 2 and includes the control mechanism comprising 20 a data processing unit for controlling operation of the machine as will be described in more detail below. The manual entry device 3 preferably



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comprises a touch screen which also displays instructions and information, but a separate touch pad or key pad may be provided in addition to the video display screen. In addition to the display screen and delivery slot 4, the front face of the console 2 preferably includes a credit card slot 23 for customer payment for orders and a receipt delivery slot.

The cassette transport device 6 will now be described in more detail with reference to Figures 3, 8 and 9. The device 6 basically comprises a truck 24 for transporting the pick-up device 7 back and forth along the track or rail 11 and an elevator mechanism 25 for moving the pick-up device up and down between the various cassette levels and the level of the delivery slot.

The truck 24 is slidably mounted at one side on the rail 11 and has a pair of wheels 26 at the other side which run on a track 27 as shown in Figures 3 and 8. The truck is driven along the rail 11 by a stepper motor 28 (see Figure 9) which



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drives the truck incrementally along a toothed rubber timing belt 29 running along the aisle 11.

A turntable 30 is rotatably mounted on shaft 31 on the truck 24, and the elevator mechanism 25 is mounted at its lower end on the turntable. Rotation of the turntable is controlled by turntable motor 32 as illustrated in Figure 8. As shown in Figure 3, the elevator mechanism is guided at its upper end by wheel 33 running in a guide track 34 extending along the upper wall 35 of the machine.

The elevator mechanism 25 comprises an elevator drive screw 36 extending vertically from the truck 24 on which the pick-up device 7 is mounted so as to be driven up and down by rotation of the drive screw in opposite directions. The drive screw is driven by elevator motor 37 which is mounted on the turntable 30. Vertical guides 38 are provided for stability of the pick-up device 7 as it is driven up and down.

The pick-up device is shown in more detail in Figures 10 to 15. It basically comprises a pair of



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gripper jaws 39 slidably mounted on slide rails 40 in a housing 41. The housing 41 is driven up and down on the elevator by means of the drive screw 36 which engages in the bore 42 in a side flange 43 of 5 the housing (see Figure 8), and the guides 38 pass through the bores 44 which are also located in flange 43.

As shown in Figures 10 and 11, the jaws 39 are driven by a stepper motor 45 along a drive screw 46 between the retracted position shown in solid outline and the advanced position shown in dotted outline. In the advanced position the jaws project out just far enough to engage around the projecting end of a videocassette 17 in a compartment 16 facing the pick-up device. A sensor 47 mounted on the jaws detects when a videocassette is in position between the jaws, and a jaw actuating solenoid 48 is actuated in response to signals from the sensor to rotate the jaws into a cassette 15 gripping position. The gap between adjacent videocassettes is sufficient to enable the jaws to 20 pick up cassettes smoothly (see Figure 10).



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A magnetic bar code read/write assembly 49 is provided in the housing 41 as shown in Figure 15. The assembly includes read/write head 50 positioned to read the magnetic strips of videocassettes as they are withdrawn into the housing. The assembly 49 also allows data to be written on the strips, such as the rental date and customer credit card information.

The operation of the various motors of the transport and pick-up devices is controlled by the data processing unit 51, as indicated in Figure 18. In the initial set up of the machine and stocking of the storage area, each compartment in the storage area will be associated in data processor memory 52 with a particular videocassette stored in that compartment. This can be done using the pick-up device and read/write assembly to load videocassettes into the storage area. Thus no particular arrangement of the videocassettes is necessary and they may be stored completely randomly. Clearly the information can be up-dated



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easily as necessary whenever stock is replaced and/or new titles are added to the available videocassettes.

Whenever a customer selects a videocassette to  
5 rent or purchase, the necessary information will be  
entered on the touch screen. If the selected  
cassette is available, the truck motor will be  
actuated at the command of the data processing unit  
51 and the truck will be driven along the rail 11  
10 until the column or cartridge 18 containing the  
selected videocassette is reached. The elevator  
motor 37 is then actuated to drive the pick-up  
device to the level of the compartment containing  
the selected videocassette (see Figure 3). If  
15 necessary the turntable motor 32 is actuated to  
rotate the pick-up device so that the jaws face  
towards the correct compartment.

Accurate positioning of the pick-up device is  
ensured by the prior calibration of the various  
20 motors under the control of the computer 51. In  
the preferred embodiment, the truck, turntable,  
elevator and jaw driving motors are all stepper



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motors with timing belt drives so that the computer control acts to step each motor incrementally until the correct position is reached. If desired, position sensors may also be used for correct 5 positioning of the pick-up device.

When the jaws are positioned facing a selected videocassette as illustrated in solid lines in Figure 10, the motor 45 is actuated to drive the jaws out of the housing until they reach the 10 videocassette. The extended position is shown in dotted outline. The solenoid 48 is then actuated to rotate the jaws to grip the videocassette, and the motor 45 is driven in reverse to retract the jaws and the videocassette back into the housing 15 41. As the videocassette passes across the read/write head 50 a check is made to ensure that the correct videocassette has been picked up, and any necessary information is written onto the magnetic strip.

20 The truck motor will then be actuated to drive the entire mechanism back to the customer console, the elevator motor will drive the pick-up device up



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or down to the level of the delivery slot, and the pick up jaws will be driven out to release the videocassette into the slot.

5       The procedure is reversed when a customer returns a rented video cassette to the machine. After a cassette has been purchased or returned, a receipt will be printed and delivered to the customer.

10      To speed up the procedure when the machine is busy or when a customer has selected or returned more than one videocassette, a temporary storage area 53 is preferably provided on the truck 24, as shown in Figure 16. The storage area 53 comprises two arcuate sections of storage compartments 54 on 15 either side of the turntable 30. When the pick-up device picks up the first of several videocassettes from the storage area or delivery slot, it will be lowered to the level of the truck and rotated into alignment with one of the temporary storage compartments. The videocassette will be dropped off in the compartment 54 temporarily while the 20



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next cassette is picked up. Thus a series of cassettes can be transported to and from the storage area or delivery slot at the same time.

Figure 17 shows an alternative embodiment of the vending machine. In this embodiment the storage area is in the form of a circular set of shelves 55 comprising an array of individual videocassette compartments 56 as in the previous embodiment. The customer console (not shown) is mounted in the gap 57 in the circular array, and the transport device 58 is located in the center of the array. The pick-up device 7 in this case will be the same as in the first embodiment, while the transport device will simply comprise a turntable and elevator to rotate the pick-up device and raise and lower it until it faces towards a particular compartment or the delivery slot. In this embodiment the storage area cannot be expanded easily as in the first embodiment, but the transport device is simpler and the machine will take up less space.



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The videocassette machine of the two embodiments described above can be used to rent or purchase videocassettes and to return rented videocassettes automatically, without the need for 5 staff to keep extensive records. The machine may also stock other items such as video game cartridges for rental or sale, and blank cassettes and other accessories for sale. The computer is programmed to continuously up-date the list of 10 available items, for example as items are purchased or rented or as stock is updated.

The machine may also be used as a self-service terminal for sale or rental of other items. It would be particularly useful for dispensing such 15 items as music cassettes, books, and the like which must be stored in great variety and numbers. In all of these cases stores must normally keep a large stock and shop assistants must spend a great amount of time in arranging the stock logically so 20 that individual titles can be easily located and in keeping track of what is and is not available at



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any time. When items are rented it is particularly difficult and time consuming to keep accurate records. With the present invention the machine can be stocked anyhow, with the computer automatically keeping track of the position of each specific item by reading the bar code of each item as it is located in a compartment in the storage area and associating that compartment with that particular item. The computer will also keep track of items that have been rented in its memory.

In the first embodiment the modular arrangement allows the storage area to be easily increased as necessary.

The videocassette dispensing machine may include other features for security and ease of use. A communication modem allowing telephone communication between the vending machine and a remote host computer may be provided, for example to allow maintenance personnel to be informed of any breakdown or possibly to allow phone-in reservation of specific items by customers.



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Various fire and security detectors may be provided to activate suitable alarms. A fire extinguisher automatically operated on smoke detection may be provided. This will be of the inert gas type (e.g. 5 Halon 13) to prevent damage to the stored tapes. The security detectors may suitably take the form of ultrasonic sensors arranged to detect vibration or tilt as the result of break-in attempts.

A back-up power supply may be provided to 10 operate the machine for a limited time in the event of a power failure. Temperature sensors may be provided to actuate fans and dampers to control the internal temperature of the machine and to maintain it in the preferred range of -20 to +25 15 degrees Centigrade. An internal heating and cooling unit may be provided so that the machine can be situated outdoors if desired.

Although a preferred embodiment of the invention has been described by way of example, it 20 will be understood by those skilled in the field that modifications may be made to the preferred



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embodiment without departing from the scope of the invention, which is defined in the appended claims.

5



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CLAIMS

1. An automatic videocassette dispensing machine for purchase, rental and return of items on a self-service basis, the machine comprising:

means for storing a plurality of items in a plurality of locations;

5 a manual entry device for customer orders for selected items;

a delivery device for delivering items to customers and receiving returned rental items  
10 from customers;

a pick-up device for picking up and releasing items to and from the storage means and delivery device;

15 means for transporting the pick-up device between the storage means and the delivery device; and

control means for associating each storage location with a particular item and for controlling said transport means in  
20 response to customer orders at said manual entry device to drive said pick-up device to



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the location of a customer selected item and to pick up the selected item and deliver it to the customer, and for controlling said transport device in response to customer returns of rented items to pick up returned items from the delivery slot and drive the pick-up device to the storage area and return the item to a storage location.

10       2. The machine of Claim 1 arranged for purchase, rental and return of videocassettes and having storing means including a storage area comprising two rows of shelves for storing videocassettes facing one another with an aisle between the  
15      shelves, said transport means comprising means for driving said pick-up device along said aisle between said delivery device and customer selected locations in said storage area, and means for moving said pick-up device vertically between the  
20      level of said delivery device and any of the shelf levels in said storage area.



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3. The machine of Claim 2, wherein each row of the shelves comprises an array of individual videocassette retaining compartments of a size such that videocassettes in said compartments 5 project out partially into said aisle.

4. The machine of Claim 2, wherein said storage area is made up of one or more modular units connected together end to end.

10

5. The machine of Claim 4, wherein said units each comprise spaced shelf sections with an aisle section between said shelf section, and said storage area further includes a console unit 15 connected to one of said shelf units and comprising a central aisle with a row of cassette retaining shelves on one side of said aisle and a customer console mounted on the other side of said aisle so as to face outwardly from said storage area, said 20 console including said manual entry device and said delivery device.



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6. The machine of Claim 5, wherein said rows of shelves are made up of a plurality of separate cassette cartridges each comprising a vertical column of cassette retaining compartments, said units having means for releasably engaging said cartridges side by side to define said shelf rows.

7. The machine of Claim 2, wherein said aisle has a guide rail extending along its length, and said drive means comprises a truck engaging said guide rail and a motor for driving said truck to and fro along said rail, said means for moving said pick-up device vertically comprising an elevator mechanism mounted on said truck.

15

8. The machine of Claim 7, wherein said pick-up device comprises a pick-up housing mounted on said elevator mechanism, a pair of pick-up jaws for gripping and carrying videocassettes to and from their compartments and the delivery device, said pick-up jaws being slidably mounted in said



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housing, and means for driving said jaws between a retracted position in said housing and an extended position, in which they project out of said housing.

5

9. The machine of Claim 8, wherein said elevator mechanism is rotatably mounted on said truck, and a motor for rotating said elevator mechanism and pick-up device is mounted on said truck.

10

10. The machine of Claim 8, wherein a magnetic read/write assembly associated with said control means for reading the magnetic strips on videocassettes and writing information on said 15 strips is mounted in said pick-up housing.

11. The machine of Claim 7, wherein said truck has a temporary storage area for a plurality of videocassettes, said pick-up device further 20 comprising means for moving videocassettes in and out of said temporary storage area.



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FIG. 1

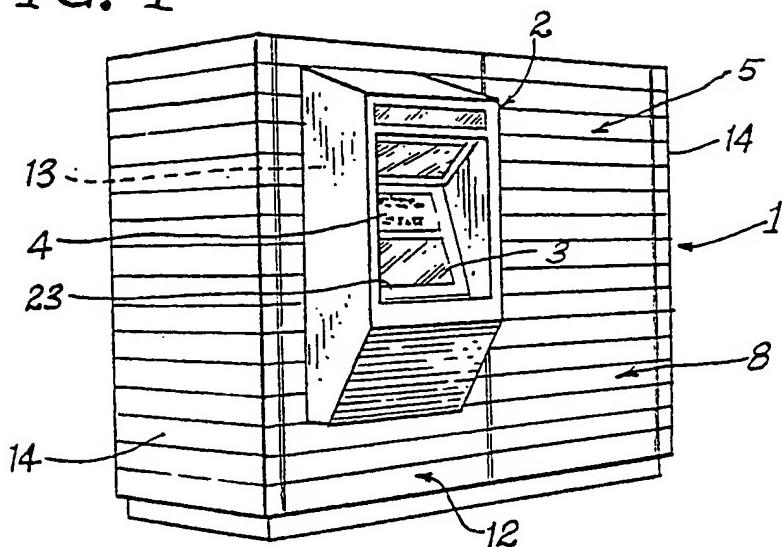
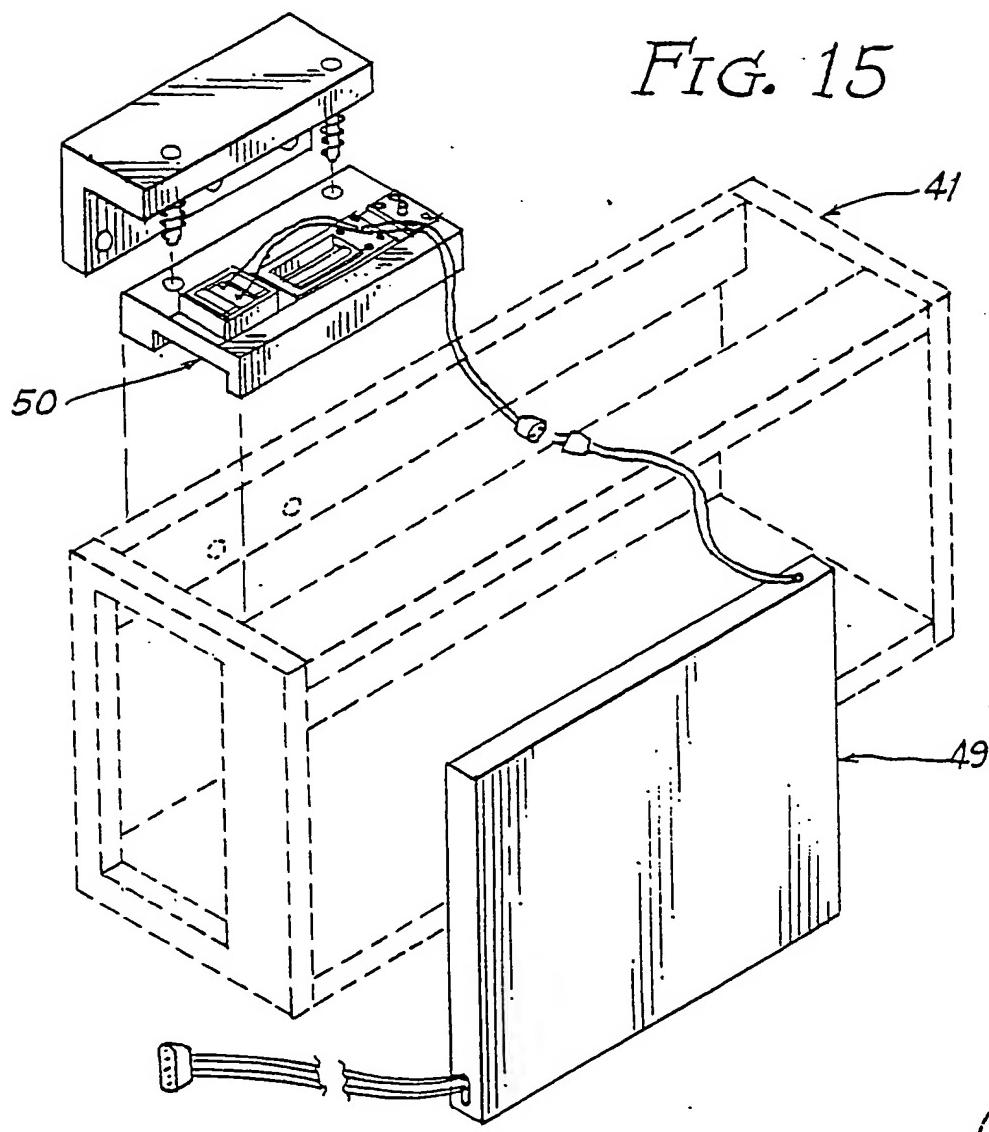


FIG. 15



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FIG. 2

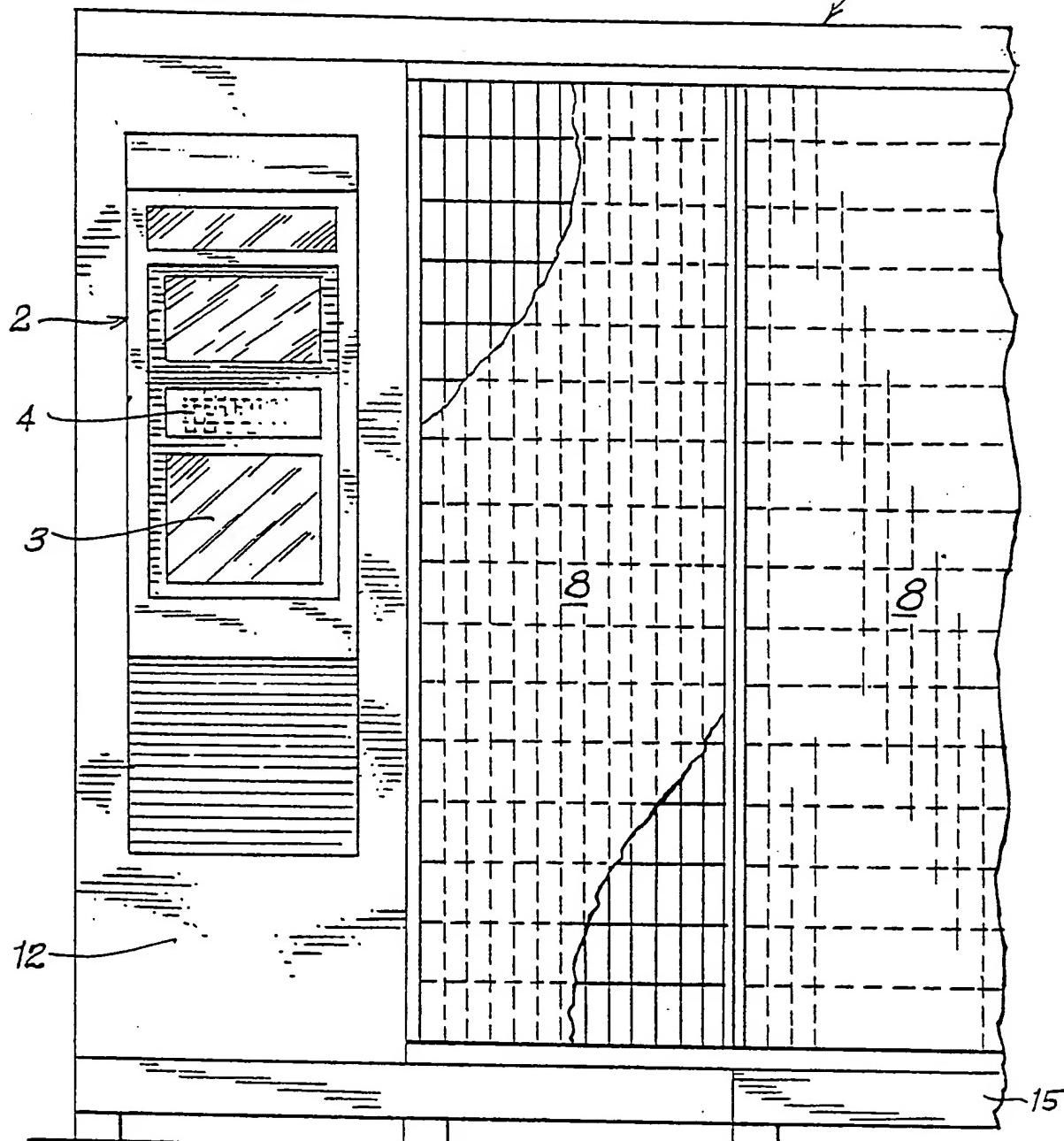
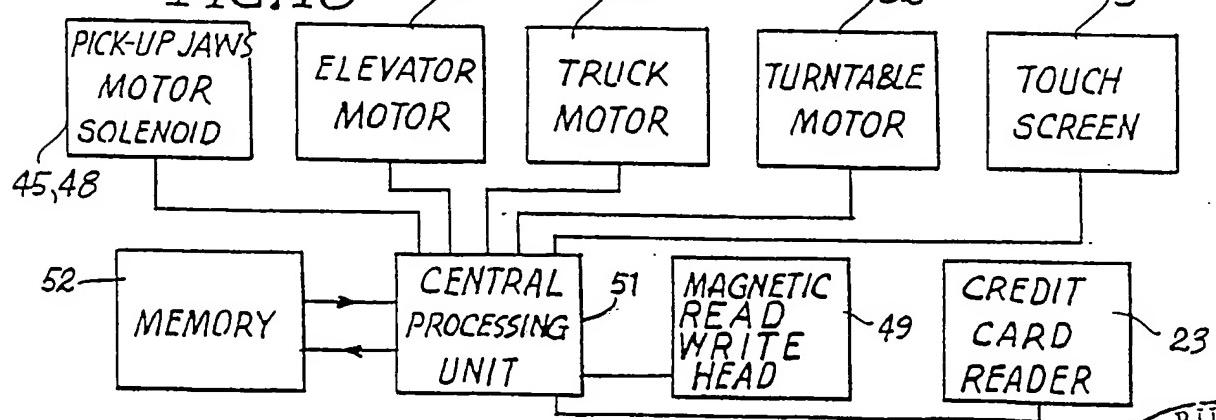
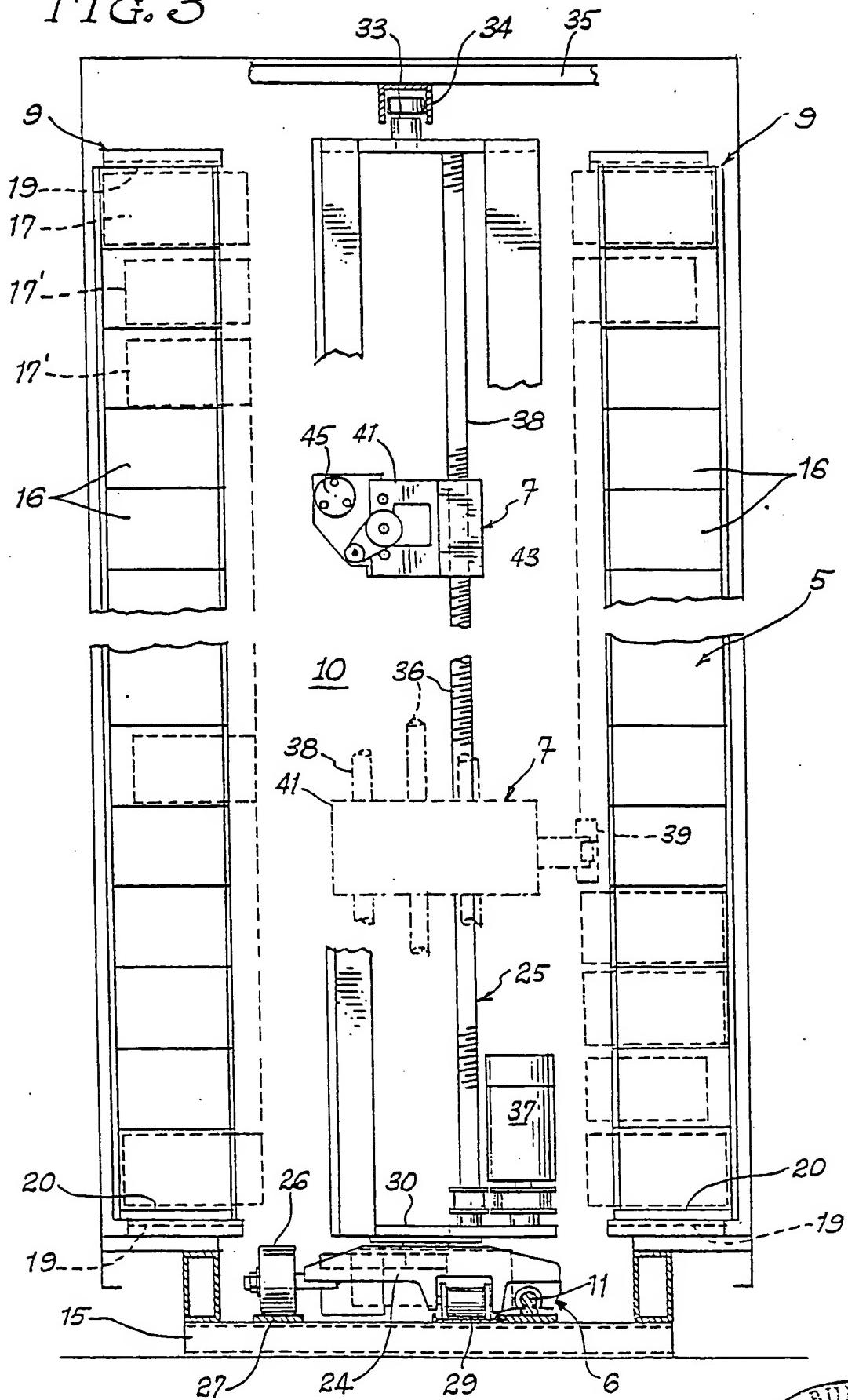


FIG. 18



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FIG. 3



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FIG. 4

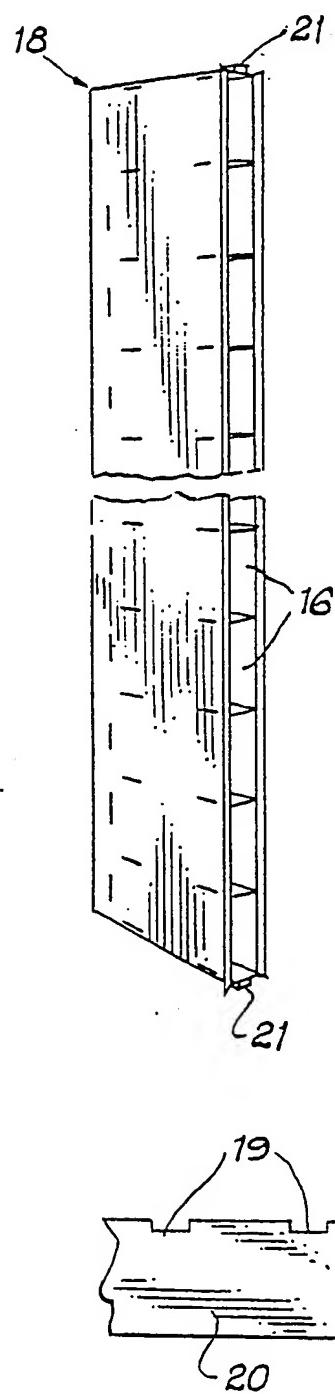


FIG. 6

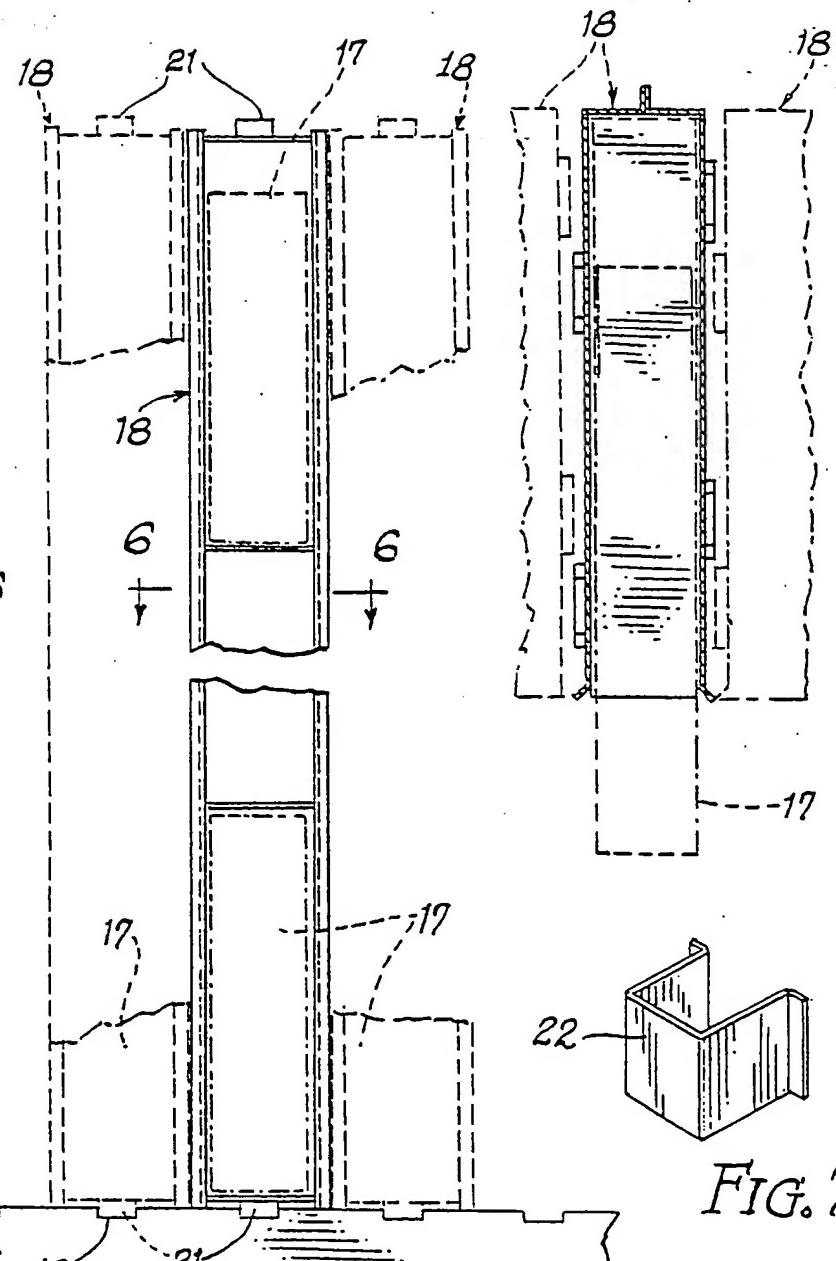


FIG. 7

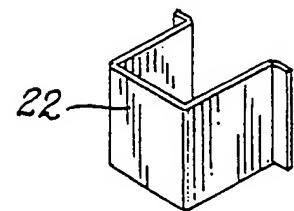


FIG. 5

FIG. 8

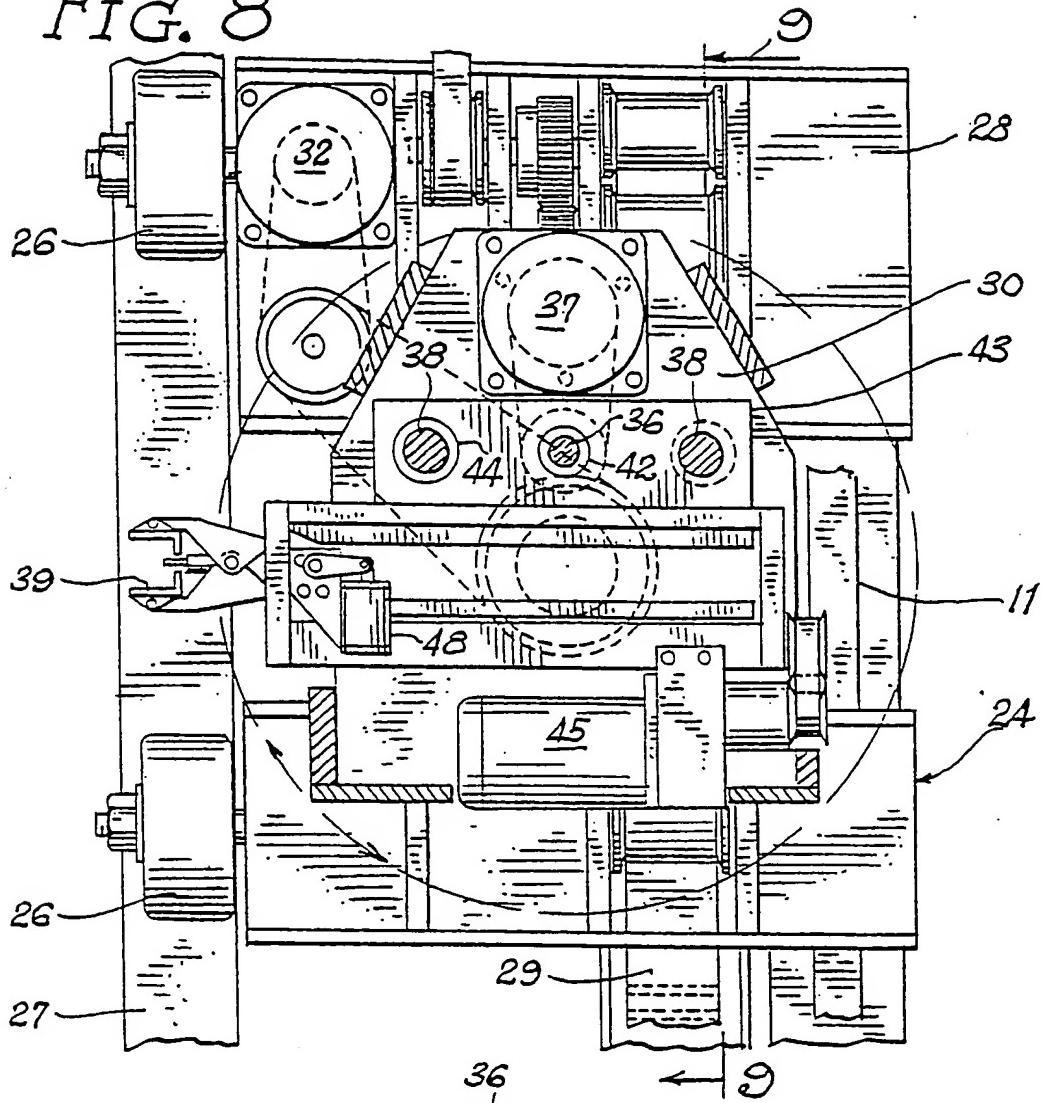
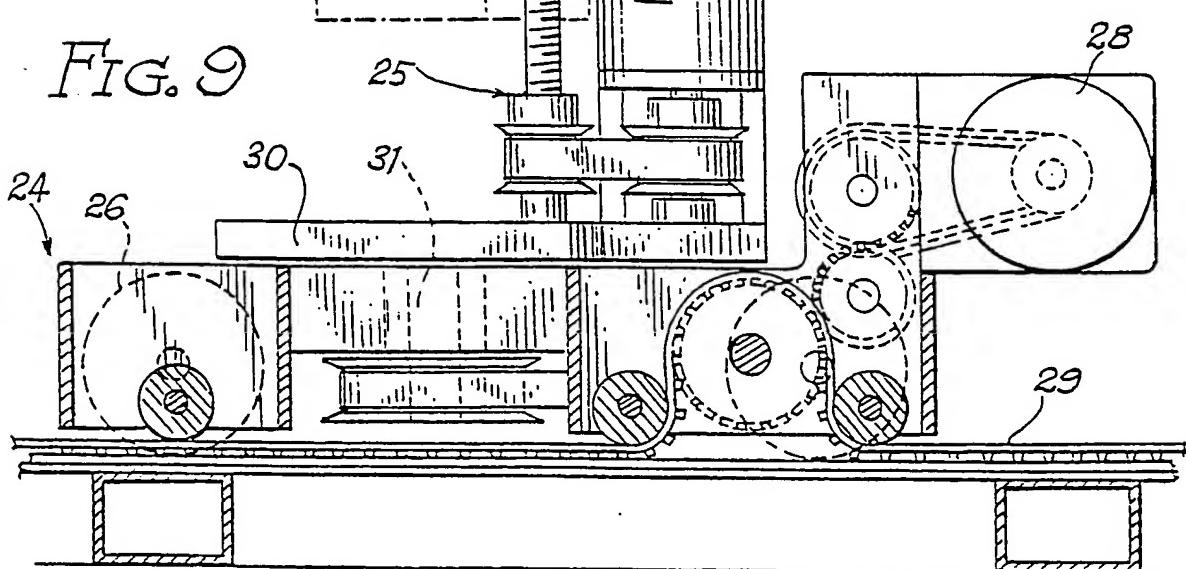


FIG. 9



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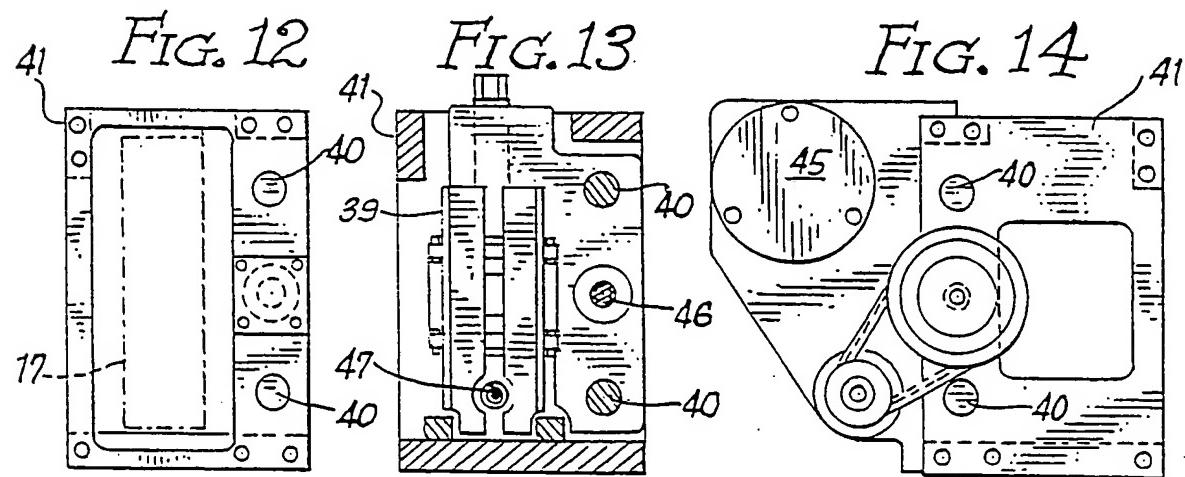
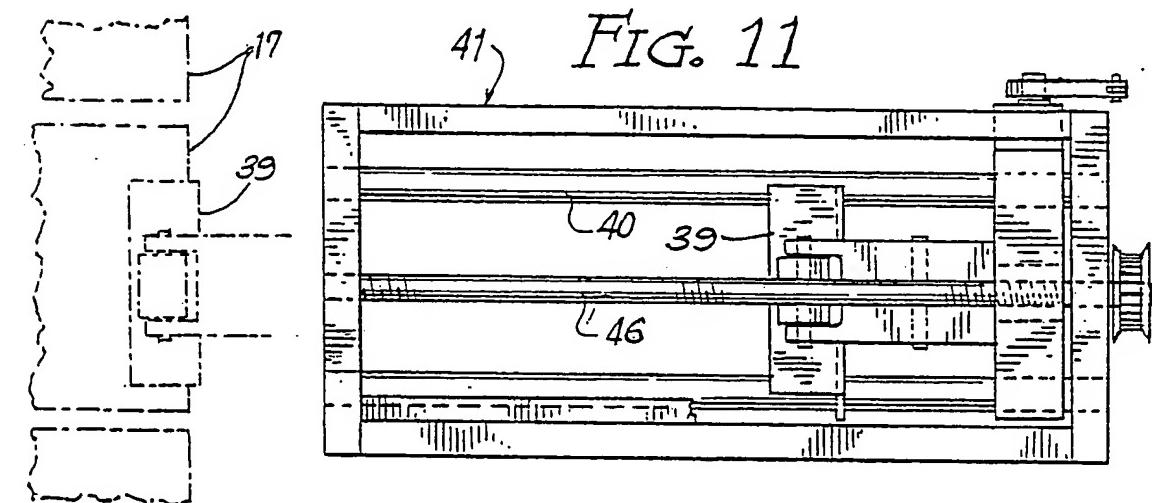
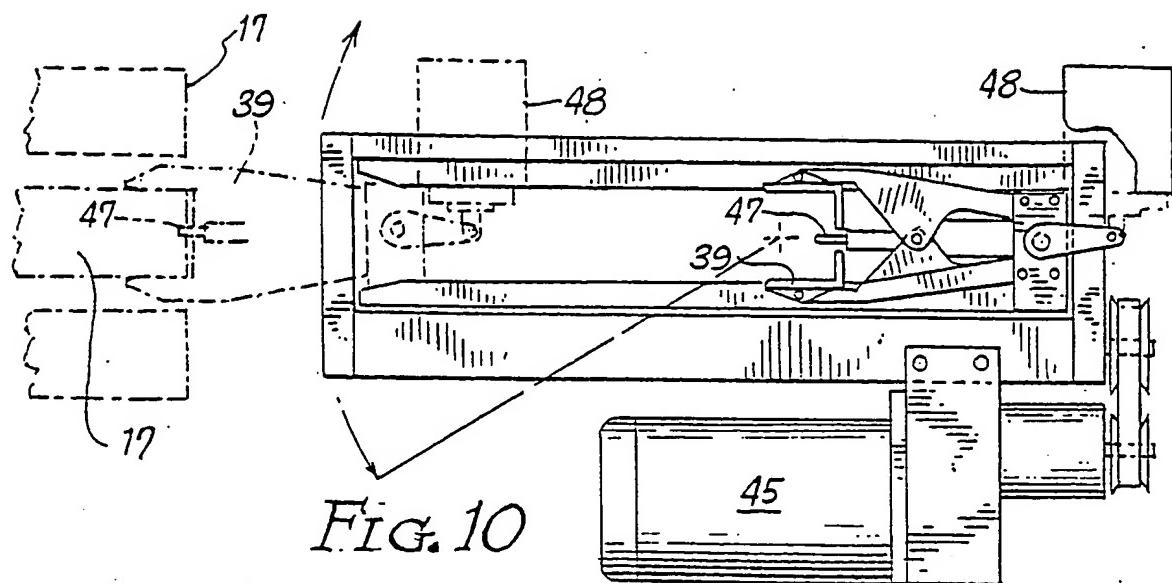


FIG. 16

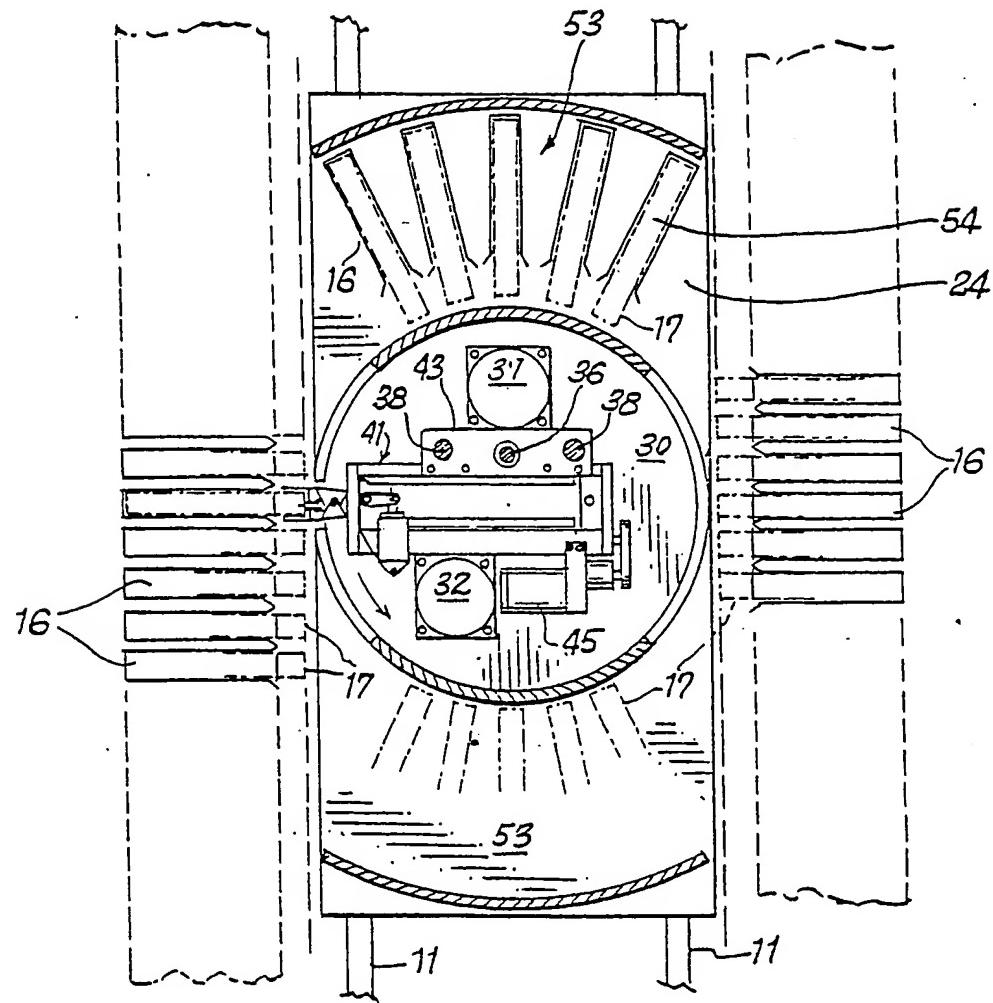
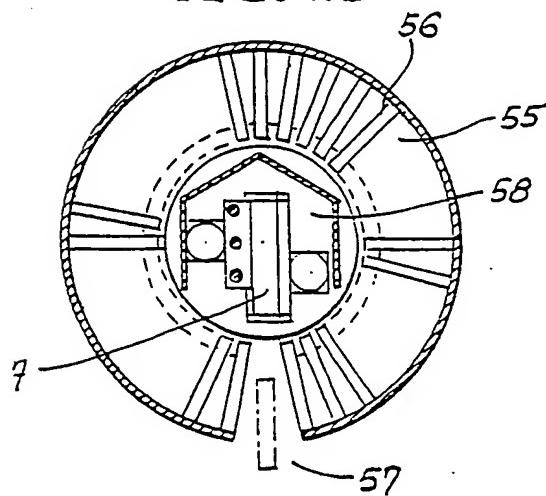
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FIG. 17



# INTERNATIONAL SEARCH REPORT

International Application No PCT/US84/01701

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) <sup>3</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC  
 INT. CL. G07F 11/62  
 U.S. CL. 221/88

## II. FIELDS SEARCHED

Minimum Documentation Searched <sup>4</sup>

Classification System	Classification Symbols
U.S.	221/2, 5, 87, 88 235/380, 381, 383 364/479

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>

## III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>14</sup>

Category <sup>6</sup>	Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
X, Y	JP, A, 54-66806, (Tadashi Kubota), 29 May 1979.	1-11
X, Y	US, A, 4,458,802, (Maciver et al), 10 July 1984.	1-11
Y	US, A, 4,414,467, (Gould et al), 8 November 1983.	1-11
Y	US, A, 4,300,040, (Gould et al), 10 November 1981.	1-11

\* Special categories of cited documents: <sup>15</sup>

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search <sup>19</sup>

12 December 1984

Date of Mailing of this International Search Report <sup>20</sup>

20 DEC 1984

International Searching Authority <sup>21</sup>

ISA/US

Signature of Authorized Officer <sup>22</sup>

F. J. Bartuska